

## 第12章 Linux 数据结构

本章列出了Linux中用到的且在本书中出现过的主要数据结构。

### blk\_dev\_struct

用该数据结构注册对缓冲区缓存可用的块设备，它们统一保存在 blk\_dev向量中。

```
struct blk_dev_struct {
    void (*request_fn)(void);
    struct request * current_request;
    struct request plug;
    struct tq_struct plug_tq;
};
```

### buffer\_head

本数据结构包含了缓冲区缓存中一块缓冲区的信息

```
/* bh state bits */
#define BH_Uptodate 0 /* 1 if the buffer contains
valid data */
#define BH_Dirty 1 /* 1 if the buffer is dirty */
#define BH_Lock 2 /* 1 if the buffer is locked */
#define BH_Req 3 /* 0 if the buffer has been invalidated */
#define BH_Touched 4 /* 1 if the buffer has been touched (aging) */
#define BH_Has_aged 5 /* 1 if the buffer has been aged (aging) */
#define BH_Protected 6 /* 1 if the buffer is protected */
#define BH_FreeOnIO 7 /* 1 to discard the buffer_head after IO */

struct buffer_head {
    /* First cache line: */
    unsigned long b_blocknr; /* block number */
    kdev_t b_dev; /* device (B_FREE = free) */
    kdev_t b_rdev; /* Real device */
    unsigned long b_rsector; /* Real buffer location on disk */
    struct buffer_head *b_next; /* Hash queue list */
    struct buffer_head *b_this_page; /* circular list of buffers in one
page */

    /* Second cache line: */
    unsigned long b_state; /* buffer state bitmap (above) */
    struct buffer_head *b_next_free;
    unsigned int b_count; /* users using this block */
    unsigned long b_size; /* block size */

    /* Non-performance-critical data follows. */
    char *b_data; /* pointer to data block */
    unsigned int b_list; /* List that this buffer appears */
};
```

```

unsigned long      b_flush_time; /* Time when this (dirty) buffer
                                * should be written          */
unsigned long      b_lru_time;   /* Time when this buffer was
                                * last used.                  */

struct wait_queue  *b_wait;
struct buffer_head *b_prev;      /* doubly linked hash list    */
struct buffer_head *b_prev_free; /* doubly linked list of buffers */
struct buffer_head *b_reqnext;   /* request queue             */
};

```

## device

每一个系统中的网络设备均由一个 device 数据结构所代表。

```

struct device
{
    /*
     * This is the first field of the "visible" part of this structure
     * (i.e. as seen by users in the "Space.c" file). It is the name
     * the interface.
     */
    char                *name;

    /* I/O specific fields */
    unsigned long      rmem_end;      /* shmem "recv" end          */
    unsigned long      rmem_start;    /* shmem "recv" start        */
    unsigned long      mem_end;       /* shared mem end            */
    unsigned long      mem_start;     /* shared mem start          */
    unsigned long      base_addr;     /* device I/O address        */
    unsigned char      irq;           /* device IRQ number         */

    /* Low-level status flags. */
    volatile unsigned char start,      /* start an operation        */
                        interrupt;     /* interrupt arrived         */
    unsigned long      tbusy;          /* transmitter busy          */
    struct device      *next;

    /* The device initialization function. Called only once. */
    int                (*init)(struct device *dev);

    /* Some hardware also needs these fields, but they are not part of
       the usual set specified in Space.c. */
    unsigned char      if_port;        /* Selectable AUI,TP,       */
    unsigned char      dma;            /* DMA channel               */

    struct enet_statistics* (*get_stats)(struct device *dev);

    /*
     * This marks the end of the "visible" part of the structure. All
     * fields hereafter are internal to the system, and may change at
     * will (read: may be cleaned up at will).
     */
}

```

```

*/

/* These may be needed for future network-power-down code. */
unsigned long      trans_start;    /* Time (jiffies) of
                                   last transmit */
unsigned long      last_rx;        /* Time of last Rx */
unsigned short     flags;          /* interface flags (BSD)*/
unsigned short     family;         /* address family ID */
unsigned short     metric;         /* routing metric */
unsigned short     mtu;            /* MTU value */
unsigned short     type;           /* hardware type */
unsigned short     hard_header_len; /* hardware hdr len */
void              *priv;          /* private data */

/* Interface address info. */
unsigned char      broadcast[MAX_ADDR_LEN];
unsigned char      pad;
unsigned char      dev_addr[MAX_ADDR_LEN];
unsigned char      addr_len;       /* hardware addr len */
unsigned long      pa_addr;        /* protocol address */
unsigned long      pa_brdaddr;     /* protocol broadcast addr*/
unsigned long      pa_dstaddr;     /* protocol P-P other addr*/
unsigned long      pa_mask;        /* protocol netmask */
unsigned short     pa_alen;        /* protocol address len */

struct dev_mc_list *mc_list;       /* M'cast mac addrs */
int               mc_count;        /* No installed mcasts */

struct ip_mc_list *ip_mc_list;     /* IP m'cast filter chain */
__u32             tx_queue_len;    /* Max frames per queue */

/* For load balancing driver pair support */
unsigned long      pkt_queue;       /* Packets queued */
struct device      *slave;          /* Slave device */
struct net_alias_info *alias_info;  /* main dev alias info */
struct net_alias   *my_alias;       /* alias devs */

/* Pointer to the interface buffers. */
struct sk_buff_head buffs[DEV_NUMBUFFS];

/* Pointers to interface service routines. */
int (*open)(struct device *dev);
int (*stop)(struct device *dev);
int (*hard_start_xmit)(struct sk_buff *skb,
                       struct device *dev);
int (*hard_header)(struct sk_buff *skb,
                   struct device *dev,
                   unsigned short type,
                   void *daddr,
                   void *saddr,
                   unsigned len);

```

```

int                (*rebuild_header)(void *eth,
                                     struct device *dev,
                                     unsigned long raddr,
                                     struct sk_buff *skb);
void               (*set_multicast_list)(struct device *dev);
int               (*set_mac_address)(struct device *dev,
                                     void *addr);
int               (*do_ioctl)(struct device *dev,
                              struct ifreq *ifr,
                              int cmd);
int               (*set_config)(struct device *dev,
                              struct ifmap *map);
void              (*header_cache_bind)(struct hh_cache **hhp,
                                       struct device *dev,
                                       unsigned short htype,
                                       __u32 daddr);
void              (*header_cache_update)(struct hh_cache *hh,
                                       struct device *dev,
                                       unsigned char * haddr);
int               (*change_mtu)(struct device *dev,
                              int new_mtu);
struct iw_statistics* (*get_wireless_stats)(struct device *dev);
};

```

### device\_struct

该数据结构用于注册字符设备和块设备（包含了设备名和该设备所支持的文件操作），chrdevs和blkdevs向量中的每一个正确成员均指代一个字符设备或块设备。

```

struct device_struct {
    const char * name;
    struct file_operations * fops;
};

```

### file

对应于每一个打开的文件。

```

struct file {
    mode_t f_mode;
    loff_t f_pos;
    unsigned short f_flags;
    unsigned short f_count;
    unsigned long f_reada, f_ramax, f_raend, f_ralen, f_rawin;
    struct file *f_next, *f_prev;
    int f_owner; /* pid or -pgrp where SIGIO should be sent */
    struct inode * f_inode;
    struct file_operations * f_op;
    unsigned long f_version;
    void *private_data; /* needed for tty driver, and maybe others */
};

```

### files\_struct

对应于每一个进程所打开的文件。

```
struct files_struct {
    int count;
    fd_set close_on_exec;
    fd_set open_fds;
    struct file * fd[NR_OPEN];
};
```

### fs\_struct

```
struct fs_struct {
    int count;
    unsigned short umask;
    struct inode * root, * pwd;
};
```

### gendisk

该数据结构保存有一个硬盘的信息。

```
struct hd_struct {
    long start_sect;
    long nr_sects;
};

struct gendisk {
    int major;                /* major number of driver */
    const char *major_name;   /* name of major driver */
    int minor_shift;          /* number of times minor is shifted to
                               get real minor */
    int max_p;                /* maximum partitions per device */
    int max_nr;               /* maximum number of real devices */

    void (*init)(struct gendisk *);
                               /* Initialization called before we
                               do our thing */
    struct hd_struct *part;   /* partition table */
    int *sizes;               /* device size in blocks, copied to
                               blk_size[] */
    int nr_real;              /* number of real devices */

    void *real_devices;       /* internal use */
    struct gendisk *next;
};
```

### inode

该数据结构保存有硬盘上的一个文件或目录信息。

```
struct inode {
    kdev_t                i_dev;
    unsigned long         i_ino;
    umode_t               i_mode;
    nlink_t               i_nlink;
    uid_t                 i_uid;
```

```

gid_t          i_gid;
kdev_t          i_rdev;
off_t           i_size;
time_t          i_atime;
time_t          i_mtime;
time_t          i_ctime;
unsigned long   i_blksize;
unsigned long   i_blocks;
unsigned long   i_version;
unsigned long   i_nrpages;
struct semaphore i_sem;
struct inode_operations *i_op;
struct super_block *i_sb;
struct wait_queue *i_wait;
struct file_lock *i_flock;
struct vm_area_struct *i_mmap;
struct page     *i_pages;
struct dquot    *i_dquot[MAXQUOTAS];
struct inode    *i_next, *i_prev;
struct inode    *i_hash_next, *i_hash_prev;
struct inode    *i_bound_to, *i_bound_by;
struct inode    *i_mount;
unsigned short  i_count;
unsigned short  i_flags;
unsigned char   i_lock;
unsigned char   i_dirt;
unsigned char   i_pipe;
unsigned char   i_sock;
unsigned char   i_seek;
unsigned char   i_update;
unsigned short  i_writecount;
union {
    struct pipe_inode_info pipe_i;
    struct minix_inode_info minix_i;
    struct ext_inode_info ext_i;
    struct ext2_inode_info ext2_i;
    struct hpfs_inode_info hpfs_i;
    struct msdos_inode_info msdos_i;
    struct umsdos_inode_info umsdos_i;
    struct iso_inode_info isofs_i;
    struct nfs_inode_info nfs_i;
    struct xiafs_inode_info xiafs_i;
    struct sysv_inode_info sysv_i;
    struct affs_inode_info affs_i;
    struct ufs_inode_info ufs_i;
    struct socket socket_i;
    void *generic_ip;
} u;
};

```

## ipc\_perm

该数据结构描述了一个 system V IPC 对象的访问许可。

```
struct ipc_perm
{
    key_t    key;
    ushort   uid;    /* owner euid and egid */
    ushort   gid;
    ushort   cuid;   /* creator euid and egid */
    ushort   cgid;
    ushort   mode;   /* access modes see mode flags below */
    ushort   seq;    /* sequence number */
};
```

## irqaction

该数据结构描述系统中中断处理器。

```
struct irqaction {
    void (*handler)(int, void *, struct pt_regs *);
    unsigned long flags;
    unsigned long mask;
    const char *name;
    void *dev_id;
    struct irqaction *next;
};
```

## linux\_binfmt

用于指代每一种 Linux 所能理解的二进制文件格式。

```
struct linux_binfmt {
    struct linux_binfmt * next;
    long *use_count;
    int (*load_binary)(struct linux_binprm *, struct pt_regs * regs);
    int (*load_shlib)(int fd);
    int (*core_dump)(long signr, struct pt_regs * regs);
};
```

## mem\_map\_t

该数据结构包含有内存中物理页信息。

```
typedef struct page {
    /* these must be first (free area handling) */
    struct page    *next;
    struct page    *prev;
    struct inode    *inode;
    unsigned long   offset;
    struct page    *next_hash;
    atomic_t        count;
    unsigned        flags;    /* atomic flags, some possibly
                                updated asynchronously */

    unsigned        dirty:16,
                    age:8;
```

```

struct wait_queue *wait;
struct page *prev_hash;
struct buffer_head *buffers;
unsigned long swap_unlock_entry;
unsigned long map_nr; /* page->map_nr == page - mem_map */
} mem_map_t;

```

## mm\_struct

该数据结构描述了一个任务或进程的虚存。

```

struct mm_struct {
    int count;
    pgd_t *pgd;
    unsigned long context;
    unsigned long start_code, end_code, start_data, end_data;
    unsigned long start_brk, brk, start_stack, start_mmap;
    unsigned long arg_start, arg_end, env_start, env_end;
    unsigned long rss, total_vm, locked_vm;
    unsigned long def_flags;
    struct vm_area_struct *mmap;
    struct vm_area_struct *mmap_avl;
    struct semaphore mmap_sem;
};

```

## pci\_bus

每个pci\_bus数据结构指代一个系统的PCI总线。

```

struct pci_bus {
    struct pci_bus *parent; /* parent bus this bridge is on */
    struct pci_bus *children; /* chain of P2P bridges on this bus */
    struct pci_bus *next; /* chain of all PCI buses */

    struct pci_dev *self; /* bridge device as seen by parent */
    struct pci_dev *devices; /* devices behind this bridge */

    void *sysdata; /* hook for sys-specific extension */

    unsigned char number; /* bus number */
    unsigned char primary; /* number of primary bridge */
    unsigned char secondary; /* number of secondary bridge */
    unsigned char subordinate; /* max number of subordinate buses */
};

```

## pci\_dev

每一个pci\_dev数据结构指代一个系统PCI设备（包括PCI-PCI桥和PCI-ISA桥）。

```

/*
 * There is one pci_dev structure for each slot-number/function-number
 * combination:
 */
struct pci_dev {
    struct pci_bus *bus; /* bus this device is on */

```



```

struct pci_dev *sibling; /* next device on this bus */
struct pci_dev *next;    /* chain of all devices */

void *sysdata;           /* hook for sys-specific extension */

unsigned int devfn;       /* encoded device & function index */
unsigned short vendor;
unsigned short device;
unsigned int class;       /* 3 bytes: (base,sub,prog-if) */
unsigned int master : 1; /* set if device is master capable */
/*
 * In theory, the irq level can be read from configuration
 * space and all would be fine. However, old PCI chips don't
 * support these registers and return 0 instead. For example,
 * the Vision864-P rev 0 chip can use INTA, but returns 0 in
 * the interrupt line and pin registers. pci_init()
 * initializes this field with the value at PCI_INTERRUPT_LINE
 * and it is the job of pcibios_fixup() to change it if
 * necessary. The field must not be 0 unless the device
 * cannot generate interrupts at all.
 */
unsigned char irq;        /* irq generated by this device */
};

```

## request

该数据结构用于向系统中的块设备发申请。

```

struct request {
    volatile int rq_status;
#define RQ_INACTIVE      (-1)
#define RQ_ACTIVE        1
#define RQ SCSI_BUSY     0xffff
#define RQ SCSI_DONE     0xfffe
#define RQ SCSI_DISCONNECTING 0xffe0
    kdev_t rq_dev;
    int cmd;             /* READ or WRITE */
    int errors;
    unsigned long sector;
    unsigned long nr_sectors;
    unsigned long current_nr_sectors;
    char * buffer;
    struct semaphore * sem;
    struct buffer_head * bh;
    struct buffer_head * bhtail;
    struct request * next;
};

```

## rtable

每个rtable数据结构包含了将报文发往一个IP主机的信息，在IP路由缓存中用到该数据。

```

struct rtable
{

```

```

struct rtable      *rt_next;
__u32              rt_dst;
__u32              rt_src;
__u32              rt_gateway;
atomic_t           rt_refcnt;
atomic_t           rt_use;
unsigned long      rt_window;
atomic_t           rt_lastuse;
struct hh_cache    *rt_hh;
struct device      *rt_dev;
unsigned short     rt_flags;
unsigned short     rt_mtu;
unsigned short     rt_irtt;
unsigned char      rt_tos;
};

```

### semaphore

该数据结构用于保护对临界区数据结构和代码的访问。

```

struct semaphore {
    int count;
    int waking;
    int lock ;           /* to make waking testing atomic */
    struct wait_queue *wait;
};

```

### sk\_buff

当在协议层间传输数据时，用该数据结构描述数据信息。

```

struct sk_buff
{
    struct sk_buff      *next;           /* Next buffer in list          */
    struct sk_buff      *prev;           /* Previous buffer in list      */
    struct sk_buff_head *list;           /* List we are on               */
    int                  magic_debug_cookie;
    struct sk_buff      *link3;          /* Link for IP protocol level buffer chains */
    struct sock          *sk;             /* Socket we are owned by       */
    unsigned long        when;           /* used to compute rtt's        */
    struct timeval       stamp;          /* Time we arrived              */
    struct device        *dev;           /* Device we arrived on/are leaving by */
    union
    {
        struct tcphdr   *th;
        struct ethhdr   *eth;
        struct iphdr    *iph;
        struct udphdr   *uh;
        unsigned char   *raw;
        /* for passing file handles in a unix domain socket */
        void             *filp;
    } h;
};

```

```

union
{
    /* As yet incomplete physical layer views */
    unsigned char    *raw;
    struct ethhdr    *ethernet;
} mac;

struct iphdr        *ip_hdr;        /* For IPPROTO_RAW */
unsigned long       len;             /* Length of actual data */
unsigned long       csum;            /* Checksum */
__u32               saddr;          /* IP source address */
__u32               daddr;          /* IP target address */
__u32               raddr;          /* IP next hop address */
__u32               seq;             /* TCP sequence number */
__u32               end_seq;         /* seq [+ fin] [+ syn] + datalen */
__u32               ack_seq;         /* TCP ack sequence number */
unsigned char       proto_priv[16];
volatile char       acked,           /* Are we acked ? */
                   used,             /* Are we in use ? */
                   free,             /* How to free this buffer */
                   arp;              /* Has IP/ARP resolution finished */
unsigned char       tries,           /* Times tried */
                   lock,             /* Are we locked ? */
                   localroute,       /* Local routing asserted for this frame */
                   pkt_type,         /* Packet class */
                   pkt_bridged,      /* Tracker for bridging */
                   ip_summed;        /* Driver fed us an IP checksum */

#define PACKET_HOST      0           /* To us */
/*
#define PACKET_BROADCAST  1           /* To all */
/*
#define PACKET_MULTICAST  2           /* To group */
/*
#define PACKET_OTHERHOST  3           /* To someone else */
/*
    unsigned short    users;          /* User count - see datagram.c,tcp.c */
    unsigned short    protocol;       /* Packet protocol from driver. */
    unsigned int       truesize;       /* Buffer size */
    atomic_t          count;          /* reference count */
    struct sk_buff     *data_skb;      /* Link to the actual data skb */
    unsigned char      *head;          /* Head of buffer */
    unsigned char      *data;          /* Data head pointer */
    unsigned char      *tail;         /* Tail pointer */
    unsigned char      *end;           /* End pointer */
    void               (*destructor)(struct sk_buff *); /* Destruct function */
    __u16              redirport;     /* Redirect port */
};

```

## sock

每个sock数据结构保存有关于BSD套接字的特定协议信息。

```

struct sock
{
    /* This must be first. */
    struct sock      *sklist_next;
    struct sock      *sklist_prev;

    struct options    *opt;
    atomic_t          wmem_alloc;
    atomic_t          rmem_alloc;
    unsigned long     allocation;      /* Allocation mode */
    __u32             write_seq;
    __u32             sent_seq;
    __u32             acked_seq;
    __u32             copied_seq;
    __u32             rcv_ack_seq;
    unsigned short    rcv_ack_cnt;     /* count of same ack */
    __u32             window_seq;
    __u32             fin_seq;
    __u32             urg_seq;
    __u32             urg_data;
    __u32             syn_seq;
    int               users;           /* user count */
    /*
     * Not all are volatile, but some are, so we
     * might as well say they all are.
     */
    volatile char      dead,
                       urginline,
                       intr,
                       blog,
                       done,
                       reuse,
                       keepopen,
                       linger,
                       delay_acks,
                       destroy,
                       ack_timed,
                       no_check,
                       zapped,
                       broadcast,
                       nonagle,
                       bsdism;
    unsigned long      lingertime;
    int                proc;

    struct sock        *next;
    struct sock        **pprev;
    struct sock        *bind_next;
    struct sock        **bind_pprev;
    struct sock        *pair;

```

```

int          hashent;
struct sock   *prev;
struct sk_buff *volatile send_head;
struct sk_buff *volatile send_next;
struct sk_buff *volatile send_tail;
struct sk_buff_head back_log;
struct sk_buff *partial;
struct timer_list partial_timer;
long         retransmits;
struct sk_buff_head write_queue,
              receive_queue;

struct proto   *prot;
struct wait_queue **sleep;
__u32         daddr;
__u32         saddr;           /* Sending source */
__u32         rcv_saddr;      /* Bound address */
unsigned short max_unacked;
unsigned short window;
__u32         lastwin_seq;    /* sequence number when we last
                              updated the window we offer */
__u32         high_seq;      /* sequence number when we did
                              current fast retransmit */
volatile unsigned long ato;   /* ack timeout */
volatile unsigned long lrcvtime; /* jiffies at last data rcv */
volatile unsigned long idletime; /* jiffies at last rcv */
unsigned int    bytes_rcv;

/*
 * mss is min(mtu, max_window)
 */
unsigned short mtu;           /* mss negotiated in the syn's */
volatile unsigned short mss; /* current eff. mss - can change */

/*
volatile unsigned short user_mss; /* mss requested by user in ioctl */
*/
volatile unsigned short max_window;
unsigned long window_clamp;
unsigned int ssthresh;
unsigned short num;
volatile unsigned short cong_window;
volatile unsigned short cong_count;
volatile unsigned short packets_out;
volatile unsigned short shutdown;
volatile unsigned long rtt;
volatile unsigned long mdev;
volatile unsigned long rto;
volatile unsigned short backoff;
int err, err_soft; /* Soft holds errors that don't
                  cause failure but are the
cause
of a persistent failure not
just 'timed out' */

```

```

    unsigned char    protocol;
    volatile unsigned char state;
    unsigned char    ack_backlog;
    unsigned char    max_ack_backlog;
    unsigned char    priority;
    unsigned char    debug;
    int              rcvbuf;
    int              sndbuf;
    unsigned short   type;
    unsigned char    localroute;      /* Route locally only */
/*
 *   This is where all the private (optional) areas that don't
 *   overlap will eventually live.
 */
    union
    {
        struct unix_opt  af_unix;
#ifdef CONFIG_ATALK || defined(CONFIG_ATALK_MODULE)
        struct atalk_sock af_at;
#endif
#ifdef CONFIG_IPX || defined(CONFIG_IPX_MODULE)
        struct ipx_opt   af_ipx;
#endif
#ifdef CONFIG_INET
        struct inet_packet_opt af_packet;
#endif
#ifdef CONFIG_NUTCP
        struct tcp_opt      af_tcp;
#endif
    } protinfo;
/*
 *   IP 'private area'
 */
    int ip_ttl;      /* TTL setting */
    int ip_tos;      /* TOS */
    struct tcphdr dummy_th;
    struct timer_list keepalive_timer; /* TCP keepalive hack */
    struct timer_list retransmit_timer; /* TCP retransmit timer */
    struct timer_list delack_timer; /* TCP delayed ack timer */
    int ip_xmit_timeout; /* Why the timeout is running */
    struct rtable *ip_route_cache; /* Cached output route */
    unsigned char ip_hdrincl; /* Include headers ? */
#ifdef CONFIG_IP_MULTICAST
    int ip_mc_ttl; /* Multicasting TTL */
    int ip_mc_loop; /* Loopback */
    char ip_mc_name[MAX_ADDR_LEN]; /* Multicast device name
 */
    struct ip_mc_socklist *ip_mc_list; /* Group array */
#endif
/*

```

```

*   This part is used for the timeout functions (timer.c).
*/
int          timeout;          /* What are we waiting for? */
struct timer_list timer;       /* This is the TIME_WAIT/receive
                                * timer when we are doing IP
                                */

struct timeval stamp;

/*
 *   Identd
 */
struct socket *socket;

/*
 *   Callbacks
 */
void          (*state_change)(struct sock *sk);
void          (*data_ready)(struct sock *sk,int bytes);
void          (*write_space)(struct sock *sk);
void          (*error_report)(struct sock *sk);

};

```

## socket

每个socket数据结构保存一个BSD套接字的信息，但它不是独立存在的，而是 VFS inode 数据结构的一个部分。

```

struct socket {
    short          type;          /* SOCK_STREAM, ...          */
    socket_state    state;
    long           flags;
    struct proto_ops *ops;        /* protocols do most everything */
    void           *data;        /* protocol data            */
    struct socket   *conn;        /* server socket connected to  */
    struct socket   *iconn;       /* incomplete client conn.s    */
    struct socket   *next;
    struct wait_queue **wait;     /* ptr to place to wait on    */
    struct inode     *inode;
    struct fasync_struct *fasync_list; /* Asynchronous wake up list */
    struct file      *file;       /* File back pointer for gc    */
};

```

## task\_struct

每个task\_struct数据结构描述了一个系统中的进程或任务。

```

struct task_struct {
/* these are hardcoded - don't touch */
    volatile long    state;       /* -1 unrunnable, 0 runnable, >0 stopped
*/
    long             counter;
    long             priority;
    unsigned         long signal;
    unsigned         long blocked; /* bitmap of masked signals */

```

```

    unsigned        long flags;      /* per process flags, defined below */
    int errno;
    long            debugreg[8];     /* Hardware debugging registers */
    struct exec_domain *exec_domain;
/* various fields */
    struct linux_binfmt *binfmt;
    struct task_struct *next_task, *prev_task;
    struct task_struct *next_run, *prev_run;
    unsigned long    saved_kernel_stack;
    unsigned long    kernel_stack_page;
    int              exit_code, exit_signal;
/* ??? */
    unsigned long    personality;
    int              dumpable:1;
    int              did_exec:1;
    int              pid;
    int              pgrp;
    int              tty_old_pgrp;
    int              session;
/* boolean value for session group leader */
    int              leader;
    int              groups[NGROUPS];
/*
 * pointers to (original) parent process, youngest child, younger sibling,
 * older sibling, respectively. (p->father can be replaced with
 * p->p_pptr->pid)
 */
    struct task_struct *p_opptr, *p_pptr, *p_cpptr,
    *p_ysptr, *p_osptr;
    struct wait_queue *wait_chldexit;
    unsigned short    uid, euid, suid, fsuid;
    unsigned short    gid, egid, sgid, fsgid;
    unsigned long      timeout, policy, rt_priority;
    unsigned long      it_real_value, it_prof_value, it_virt_value;
    unsigned long      it_real_incr, it_prof_incr, it_virt_incr;
    struct timer_list  real_timer;
    long              utime, stime, cutime, cstime, start_time;
/* mm fault and swap info: this can arguably be seen as either
   mm-specific or thread-specific */
    unsigned long      min_flt, maj_flt, nswap, cmin_flt, cmaj_flt, cnswap;
    int swappable:1;
    unsigned long      swap_address;
    unsigned long      old_maj_flt;    /* old value of maj_flt */
    unsigned long      dec_flt;        /* page fault count of the last time */
    unsigned long      swap_cnt;       /* number of pages to swap on next pass
*/
/* limits */
    struct rlimit      rlim[RLIM_NLIMITS];
    unsigned short     used_math;
    char               comm[16];
/* file system info */

```



```

    int                link_count;
    struct tty_struct   *tty;           /* NULL if no tty */
/* ipc stuff */
    struct sem_undo     *semundo;
    struct sem_queue    *semsleeping;
/* ldt for this task - used by Wine. If NULL, default_ldt is used */
    struct desc_struct *ldt;
/* tss for this task */
    struct thread_struct tss;
/* filesystem information */
    struct fs_struct     *fs;
/* open file information */
    struct files_struct  *files;
/* memory management info */
    struct mm_struct     *mm;
/* signal handlers */
    struct signal_struct *sig;
#ifdef __SMP__
    int                processor;
    int                last_processor;
    int                lock_depth;     /* Lock depth.

                                         We can context switch in and out
                                         of holding a syscall kernel lock...

*/
#endif
};

```

### timer\_list

该数据结构用于实现进程的真实时间定时器。

```

struct timer_list {
    struct timer_list *next;
    struct timer_list *prev;
    unsigned long expires;
    unsigned long data;
    void (*function)(unsigned long);
};

```

### tq\_struct

每个tq\_struct数据结构包含有队列中一项工作的信息。

```

struct tq_struct {
    struct tq_struct *next; /* linked list of active bh's */
    int sync;              /* must be initialized to zero */
    void (*routine)(void *); /* function to call */
    void *data;             /* argument to function */
};

```

### vm\_area\_struct

每个vm\_area\_struct数据结构描述一个进程的虚内存空间。

```
struct vm_area_struct {
    struct mm_struct * vm_mm; /* VM area parameters */
    unsigned long vm_start;
    unsigned long vm_end;
    pgprot_t vm_page_prot;
    unsigned short vm_flags;
    /* AVL tree of VM areas per task, sorted by address */
    short vm_avl_height;
    struct vm_area_struct * vm_avl_left;
    struct vm_area_struct * vm_avl_right;
    /* linked list of VM areas per task, sorted by address */
    struct vm_area_struct * vm_next;
    /* for areas with inode, the circular list inode->i_mmap */
    /* for shm areas, the circular list of attaches */
    /* otherwise unused */
    struct vm_area_struct * vm_next_share;
    struct vm_area_struct * vm_prev_share;
    /* more */
    struct vm_operations_struct * vm_ops;
    unsigned long vm_offset;
    struct inode * vm_inode;
    unsigned long vm_pte; /* shared mem */
};
```